

Using Participatory Design and Visual Narrative Inquiry to Investigate Researchers' Data Challenges and Recommendations for Library Research Data Services

I. Introduction

The [removed institution] is currently engaged in efforts to build and expand research data services (RDS) and is conducting user studies on campus to better understand and support the research community's needs. This paper reports on one such study that employs a methodology influenced by participatory design and visual narrative inquiry. Two focus group sessions were conducted at [removed institution] to inform the institutional library system's development of research data services (RDS). Using the methodology presented in this paper, this study probes how early career researchers visually conceptualize the research process in their disciplines, their self-reported research data challenges and needs, and their recommendations for library RDS.

In this study, we asked eight early career researchers to sketch a representation of research in their disciplines. We encouraged them to create a generalized illustration of the shape and stages of research in their domains, rather an illustration of a specific research project. The focus group's illustrations of the research process were used as the basis for reflecting on data-related challenges and potential solutions in the form of RDS.

This study was guided by the following set of questions:

- How do early career researchers visually conceptualize the research process in their disciplines?
- What does a participatory design and visual narrative inquiry methodology reveal about participants' research data needs during the research process?
- What does participatory design and visual narrative inquiry methodology reveal about participants' recommendations for research data services that would assist them during the research process?

While we asked participants to illustrate research in their disciplines, they presented subjective, personal conceptualizations of the research process. Because of this, we were unable to draw disciplinary conclusions from the participants but observed patterns in data-related challenges that early career researchers encounter. Some cited problems inherent to their methodological approaches but others described challenges that they felt the library could help them to address. We present five thematic data-related challenge areas that emerged from the focus groups and identify the user-generated design proposals for library RDS.

II. Literature

This study draws upon and adapts a methodology termed visual narrative inquiry. Visual narrative inquiry is a derivative of narrative inquiry, a qualitative methodology that uses storytelling as a means to study individuals' experiences. Narratives are, in this methodological approach, both the means of acquiring data and the data itself (Connelly and Clandinin 1990; Bowler et al. 2014). In visual narrative inquiry studies, participants communicate their experiences visually, with photography the common mode of doing so (Bach, 2008). Library and information science researchers Bowler, Knobel, and Mattern drew inspiration from visual narrative inquiry as a methodology and considered its application in a design study with users. Bowler et al. asked focus groups composed of teens and undergraduates to, first, tell a story about cyberbullying taking place on Facebook and, second, offer ideas for design interventions that they believe would discourage bullying behavior online. In their adoption of visual narrative inquiry, the researchers asked participants to capture a narrative through sketching and the drawings became the visual data for the researchers (Bowler, Mattern, and Knobel, 2014; Bowler, Knobel, and Mattern, 2014). The study presented in this paper is heavily influenced by their work.

Bowler et al. are part of a larger community of library and information science researchers who are involving user groups in design studies. Participatory design refers to the involvement of users in the creation of services, technology, spaces, and resources. This approach, or methodology, is rooted in a belief that the role of users in the design process leads to designs that are more relevant to them and better serve their needs (Schuler and Namioka 1993; Spinuzzi 2005; Fischer, 2011; Foster 2014). Clay Spinuzzi, a faculty member in rhetoric, writes "Participatory design is research....participatory design has its own highly articulated methodological orientation, methods, and techniques" (2005, p. 163). He describes a process that involves observing and meeting with users, collaborative discovery of users' needs and goals, and joint prototyping.

Nancy Fried Foster, Senior Anthropologist at Ithaca S+R, has done much to communicate the value of participatory design to library professionals through her research, publications, and a series of workshops she has offered through the Council on Library and Information Resources (CLIR). In her 2014 CLIR edited publication titled *Participatory Design in Academic Libraries: New Reports and Findings*, Foster pulls together a collection of participatory design studies at libraries that together point to a growing interest growing interest among librarians for user engagement in the design of services, tools, and resources. Foster argues,

Library spaces, technologies, and services that are built with broad participation work better and are more responsive to the work practices and needs of real people. Beyond that, focusing on the people who use libraries, and organizing libraries

in a way that supports that focus, is a good way to ensure that libraries will identify emerging needs and shift plans and resources to meet them, rather than continuing to address disappearing ways of work (2014, p. 5).

This statement forms the driving premise of this paper's exploration of researchers' recommendations for RDS.

Jake Carlson at Purdue University Libraries draws an explicit link between the value of engaging users in RDS creation. He writes, "In developing data services, libraries must invest time and effort to understand current practices with data; when, how, and why these practices are performed; and the gaps between current and ideal practice from the perspective of the researcher" (2014, p. 79). This study contributes to the body of work that reports on users' needs around library RDS (Marcus et al., 2007; Bresnahan and Johnson, 2013; Weller and Monroe-Gulick, 2014). The outlined methodology in this paper aims to push the study of user needs further into a more explicit consideration of user-generated design recommendations for RDS.

III. Methodology

The methodology employed in this study is rooted in two methodological approaches. First, Spinuzzi's early stages of the participatory design process are visited with participants in this study. The facilitators and participants come together in focus group sessions to reflect on the research process and, from this reflection, identify data-related challenges and user-generated solutions. Second, we adapt visual narrative inquiry techniques, encouraging participants to think of the research process as a narrative to visualize. Narrative creation acts as the methodological means of probing participants' data-related challenges and generates the data that is presented and examined in this paper.

Two focus group sessions were conducted at the [removed institution] in December 2014 and January 2015. The research team, composed of faculty and librarians from the [removed institution], recruited early career researchers from the [removed school] to test the methodology during the December 2014 session. Convenience sampling was used; we found, during both the holiday season and the final weeks of the term, that we could more successfully secure participation from study participants during the busy conclusion of a term by recruiting within the [removed school], where most members of this research team are based.

About Focus Group Participants				
ID	Status	Discipline	Examples of Research Data Collected or Reused	Session
A	Doctoral Candidate in Dissertation Stage	Information Science	Open and tabular epidemiology datasets	1
B	Postdoctoral Researcher	Library and Information Sciences (LIS)	Archival sources, interviews in own research; responsible for management of tabular historical datasets in postdoctoral position	1
C	Postdoctoral Researcher		Diaries kept by study participants	1
D	Visiting Scholar		Documentation, business datasets	1
E	Postdoctoral Researcher		Survey responses, interviews	2
F	Research Associate	History and Philosophy of Science	Published research articles	2
G	Postdoctoral Researcher	Anthropology	Field journals, interviews	2
H	Postdoctoral Researcher	World History	Archival sources	2

Table I: Participant makeup in two focus group sessions

We targeted early career researchers in postdoctoral positions and, in the case of one participant, in the late stages of the dissertation. We imagined that their recent dissertation work would a useful point of reference for reflecting on data-related challenges that they or others in the disciplines encounter during the research process. Moreover, we identified postdoctoral researchers and doctoral candidates as user groups that could potentially benefit from more developed and targeted library RDS.

Based on the participants' feedback, elements of the protocol were adjusted for the January 2015 session. We continued our study of early career researchers, expanding our recruitment beyond the [removed institution] to postdoctoral researchers in the social sciences and humanities. In total, eight early career researchers participated these two pilot sessions, with four individuals in each. Table I highlights participants' roles at the [removed institution], their disciplinary communities, types data they use and collect in their research, and which session they attended.

Two members of the research team acted as facilitators for the sessions. The data we collected included sketches (the visual narratives in this study), audio recordings of the sessions, and transcriptions of the sessions. The focus group sessions were broken into six parts:

Part I. Introduction and Warm-Up

We overviewed the session objectives, explaining to participants that we would ask them to engage in sketching and discussion about the research process in their disciplines and their data-related needs and challenges. These activities laid the foundation for participants to offer recommendations about library RDS that would be helpful to them. We informed participants that their contributions would assist the library's working group to develop RDS and resources that meet the needs of researchers on campus.

After securing verbal agreement from participants to audio record the focus group, we moved into a warm-up discussion that had two primary objectives: first, to learn more about the participants' disciplinary communities and research data and, second, to prime participants to begin thinking about the research process and their data. The facilitators began this discussion by identifying the research community and discipline that we consider ourselves part of and the type of data we collect or use. We then asked the participants to do the same: to introduce themselves and their disciplinary community, to tell us something about their research area, and to identify the type of data they use or collect.

Part II. Visualizing the Research Process

Using markers and large sheets of adhesive paper, the participants were asked to sketch the research process as it operates in their discipline. We encouraged participants to abstract from an individual research project to reflect on a more high-level, generalized research process in their field. The visualized research process served as the "narrative" in this study. We avoided providing any direction that would notably influence the participants' drawings.

Part III. Review the Research Process Sketches

We asked participants to hang their drawings side by side on a wall and to individually walk us through their representations. We were prepared to pose questions that would push the conversation toward a data-related focus. To do so, we referenced and drew questions from the *Data Curation Profiles Toolkit*, an interview tool that guides information professionals in efforts to learn about disciplinary-specific data and disciplinary-specific data management practices (Witt et al., 2009). We specifically drew from Module 2 in *Data Curation Profiles Interviewers' Guide*, which provides the following questions:

- What happens to the data in each stage?
- Why does this happen (what purpose does it serve)?
- How does it happen (what tools and instruments are used in particular)?

- Who is involved (lab techs, grad students, etc.)? (Carlson 2010, pp. 7-8).

Participants in the first focus group indicated that they would have liked more opportunities for conversation among them. With this in mind during the second session, we as facilitators prioritized first posing clarifying questions rather than the questions from the *Data Curation Profiles* module. We encouraged the participants to then ask questions and respond to others' drawings and were surprised by how willing and eager the participants were to engage in conversation with one another about the drawings that hung together. They pointed to commonalities and differences among the sketches and played a greater role in directing the conversation about what was occurring in the drawings than participants had in the first focus group session.

Part IV. Enhancing the Sketches:

This stage in the methodology was adjusted for the second focus group following participants' feedback and facilitators' observations. In the first session, we asked the participants to return to the sketches and use a Post-It note to mark where in the sketched research process a library service, resource, or tool would assist them in their management of the data. The participants were to use Post-It notes to indicate (either visually or in a brief written description) what this service or resource would involve or look like.

In the second focus group session, we invited participants to talk together about data-related needs and challenges that they encounter – if they do -- during the research process. We reminded them that their needs and challenges may differ and that is to be expected. Returning to their drawings, we asked participants to capture where they encounter these data-related needs and challenges in their drawings with an orange Post-It note describing the challenge. We suggested that they use arrows to mark if they encounter the challenge at multiple points during the research process. We then asked that they brainstorm a library service, tool, or resource that would help them personally with the data-related need or challenge. The participants used blue Post-It notes to indicate and describe what this service, resource or tool would involve or look like. We asked the participants to place the blue Post-It notes at the point in their drawings where the proposed RDS would be most useful to them.

Part V. Reviewing the Proposed RDS

Hanging their drawings on a wall, participants shared the recommended RDS with the facilitators and one another. We asked the following clarifying questions for the proposed RDS (*x*):

- Could you talk about why *x* would be useful?
- Why would *x* be useful at that point?
- Do you have any thoughts about how *x* would be best delivered/accessed?

In the second focus group session, we encouraged participants to react and ask questions about the proposed RDS.

Part VI. Debriefing: In this final stage of the focus group, we asked for participants' thoughts and recommendations on the protocol. Participants in the first focus group suggested more opportunities for interaction and discussion during future sessions. More opportunities for participant interaction were consequently built into the protocol for the second session.

IV. The Research Process Sketches

Results

Eight sketches of the research process were produced over the two focus group sessions. These sketches were used as the entry point for reflection on data-related needs and challenges and for brainstorming potential design solutions.



Figure I. The Research Process, as illustrated by a library and information scientist (left, Participant B) and a philosopher and historian of science (right, Participant F)

Some of the participants represented research as a linear process, with a clear beginning point and endpoint. The left image in Figure I is an example of such an illustration. Here, the participant, a library and information scientist, described the discovery of a research question as the originating point for the research process and the development of written report as its conclusion. Her process is represented as distinct stages that neatly follow one another.

Participant F, a historian and philosopher of science, illustrates a three-stage process (Figure I, right). Like Participant B, his is linear process, but represented a tendency to cycle back to earlier stages, generally because of a set-back. In his second stage, he describes being in “a big cloud of stuff,” a metaphorical space where he must sift through an overwhelming body of literature to locate resources that are relevant and useful to his research. In his third stage, he submits a paper to a journal and receives negative feedback from reviews that pushes him back into “the cloud of craziness.” His illustration captures the unending, repeating cycle of his research.

Only one participant captured a fully nonlinear research process. In Figure II, Participant C, a library and information scientist, conceptualizes her research as a messy mind map. Her image is a less structured account of research in the field of library and information sciences than Participant B’s. It does, however, have a starting point that was clear in her verbal explication of the drawing: research begins with a reflection on her worldview. She explained, “In order to unlock a phenomenon, I’ve got to understand who I am as a researcher.” As she talked about the process, continually returned to the interaction between her worldview and the research activities, with both influencing and altering one another.

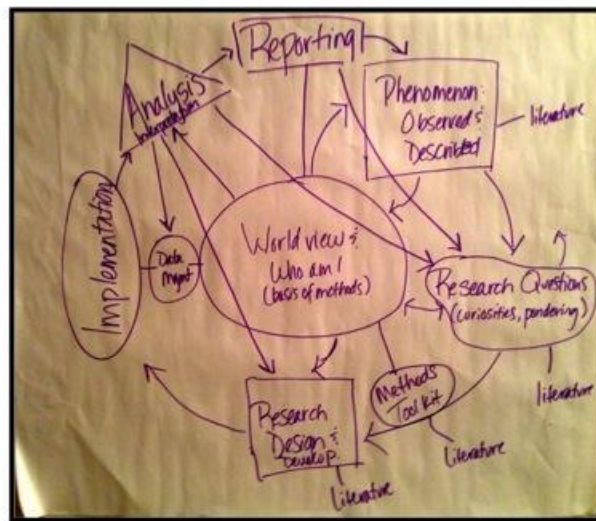


Figure II. The research process as a mind map; a drawing by a library and information scientist (Participant C)

Discussion

In designing our methodology, we wanted to guide participants away from visually representing the story of one research project. By asking them to conceptualize a more generalized process in their fields, we imagined that we could gain insight into disciplinary practices and common obstacles that they and other scholars in their departments encounter. Moreover, we imagined that a higher-level conceptualization would serve as a more amenable canvas for Phases IV and V.

Instead of focusing on challenges unique to one research project and solutions that would have assisted them in these isolated occasions, we hypothesized that participants would think bigger and more freely.

Participants were, as a whole, able to detach themselves from the experience of one project. While there were numerous references to dissertations, which many had completed less than a year before their participation, they successfully abstracted one level outward, presenting a visual representation of their general research approach. In verbally describing their drawings, they did not speak on behalf of others in their discipline. They spoke from the vantage point of an individual researcher.

As perhaps is best evidenced by Participant C's drawing, these personal and subjective renderings of research. In this way, they are distinct from the more neutral lifecycle models often used by libraries for mapping their services. In their sketches, there were elements to the research process that are invisible in the lifecycle models that we are commonly accustomed to seeing. Two participants, for example, captured "confusion" as inherent to their data analysis work.

V. Data-Related Challenges and Proposed RDS

Results

Table II overviews challenge areas that participants raised during the focus group sessions and their recommendations for library services, tools, or resources that would, from their perspective, be useful in overcoming these challenges. We identified patterns in their expressed and present examples of user-recommended RDS that would potentially act as solutions to the data-related challenges they articulated.

Research Process	Challenge Area	Proposed RDS	Participant #
I. Project Design and Data Collection	Disconnect between methodology in the classroom v. methodology in the field	Web-based resource with methodology snapshots	B
		Faculty use cases	B
		Educational sessions on methodologies led by	B

		researchers who used them in their work	
	Access to sources for data	Library portal that, among other functions, links to disciplinary data repositories	A
		Registry of study participants to interview	E
II. Data collection, data analysis, data preservation	Overly-technical or over-lengthy data management guidance that does not resonate with user groups	Distilled guide on best practices for research data management	H
		Data management training specifically geared toward qualitative, quantitative, and mixed methods researchers	B
III. Post-publication	Understanding impact of research	“Reference notifier” that alerts researchers when their work has been cited	F
IV. Active and long-term data preservation	Not knowing what infrastructure and services are available to them	Distilled guide on the library website on data storage at the [removed institution institution]	H

Table II: Data-related challenges and proposed solutions

Table II also links the challenges and proposed RDS to points in the research process. One of the design recommendations moved throughout the research process. Participant A, an information scientist, recommended a library web portal for research data services, citing the Windows 8 interface as a model for such a resource. She described grouping and presenting resources around color-coded research stages, with the portal collecting and providing resources that would be relevant to researchers throughout a project.

Discussion

Disconnect between methodology in the classroom v. methodology in the field

A webpage that “that listed common methods and how they’re usually employed – like ‘this is what this method is,’ ‘this is how people usually use it,’ ‘it’s most common in this field.’ Something like that would be

really helpful just to give you a place to start thinking about a methodology that you may not have thought about on your own."

– Participant B

For two researchers in library and information science, an interdisciplinary field with researchers who draw upon a wide swathe of methodological approaches, selecting a methodology for their data collection was a considerable hurdle during their dissertation work. Participant B explained, "We all [in my program] took at least two methodology courses as part of our degrees. But you can only learn so many methods." She indicated that a web-based library resource on methodologies would have been valuable as a doctoral student and would continue to be valuable in her postdoctoral work.

Participant C remarked, "I understand scholastically methodological approaches. It's a whole different kettle of fish when you have to play it." She offered a design recommendation for a library resource on methodology, which was influenced by what she viewed as an effective component of a qualitative methods course she completed. Her professor brought researchers who recently completed their dissertation work into the classroom to share their experiences with doctoral students who were approaching this point in their project. She suggested that a web-based resource overviewing researcher experiences with methodological approaches would be useful to her, allowing her to better understand the real-life application of research methods. Moreover, she expressed an interest in being able to reach out to faculty and potentially engage them in further discussion about their work. With this resource, Participant C was looking to the library as potentially assisting her in creating scholarly networks, by linking her to academics with whom she can engage.

These same two participants cited an absence of any discussion on research data management in their methods courses, another piece of evidence of disparity between methods in the classroom and methods in practice. Participant B described coding her interview data in Microsoft Excel. She said, "I'm not convinced that's the best way to go about managing research data. I didn't keep a copy of that Excel sheet anywhere... just have no idea how anyone else does it. I have no clue. I only know what I did. So there might be a hundred better ways that I could have managed my data when I was writing....I just remember feeling kind of lost at that point. It was my first research study and I just did the best I could." This is, clearly, an expression of need for education on research data management. Given that departmental methods courses may not be filling this knowledge gap for early career researchers, there is an opportunity for the library to assume this educational role on campus.

Overly-technical or over-lengthy data management guidance that does not resonate with user groups

*On a data management guide: "I think it's useful to have that...
Not really a book guide because I know that there are enough*

of that but sort of a distilled version of that to guide with protocols of what is proper or ethical forms of treating your data.” – Participant H

As exemplified by Participant B’s remarks on her data management practices, a number of participants were self-aware that there is room for improvement and skill-building in this area. One participant admitted that, in terms of data management, “probably there are people who are more structured in doing that” (Participant H). It became apparent from his recommendations for library RDS that he wanted to learn about how he might adjust and improve his approach to research data management. For him, a simple and concise guide that he can access on the library website would be a resource that of interest for him.

Just as hearing from actual experiences of researchers was seen as valuable in deciding on a methodological approach, one participant said that she would like to learn about how others approach data management. She proposed customized workshops on best practices for data management geared toward qualitative, quantitative, and mixed methods audiences (Participant B).

Access to sources for data

Participants identified obstacles related to access to data, some of which the library can not necessarily solve. For example, Participant G, an anthropologist, described the metaphorical gap that separates an ethnographer doing field work from his study population, his data source, as a major obstacle during his research (Figure III). This obstacle is, from his perspective, inherent to the research process in his discipline; it is not one that an academic library can remove or ease.

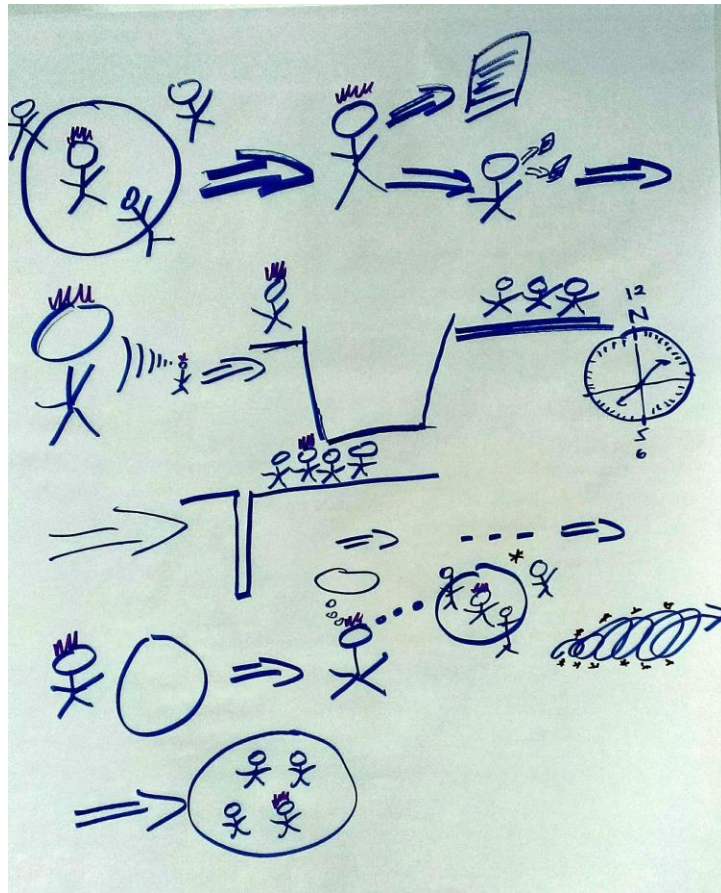


Figure III. The research process as illustrated by Participant G, an ethnographic researcher. When entering the field, Participant G (depicted as figure with purple hair) described himself as encountering a large abyss that separates him from his study population. Only time and proximity, he said, can help him to overcome this obstacle.

Participant H, too, expressed challenges that are characteristic to his methodology, historiography (Figure IV). With his reliance on archival sources, the necessity of travel in order to access the data he needs. This is not a challenge that the library can necessarily mitigate and the participant acknowledged this reality. But by continuing with the digitization of its own archival and special collections holdings, the library can potentially remove some of these access challenges for remote researchers interested in the collections.

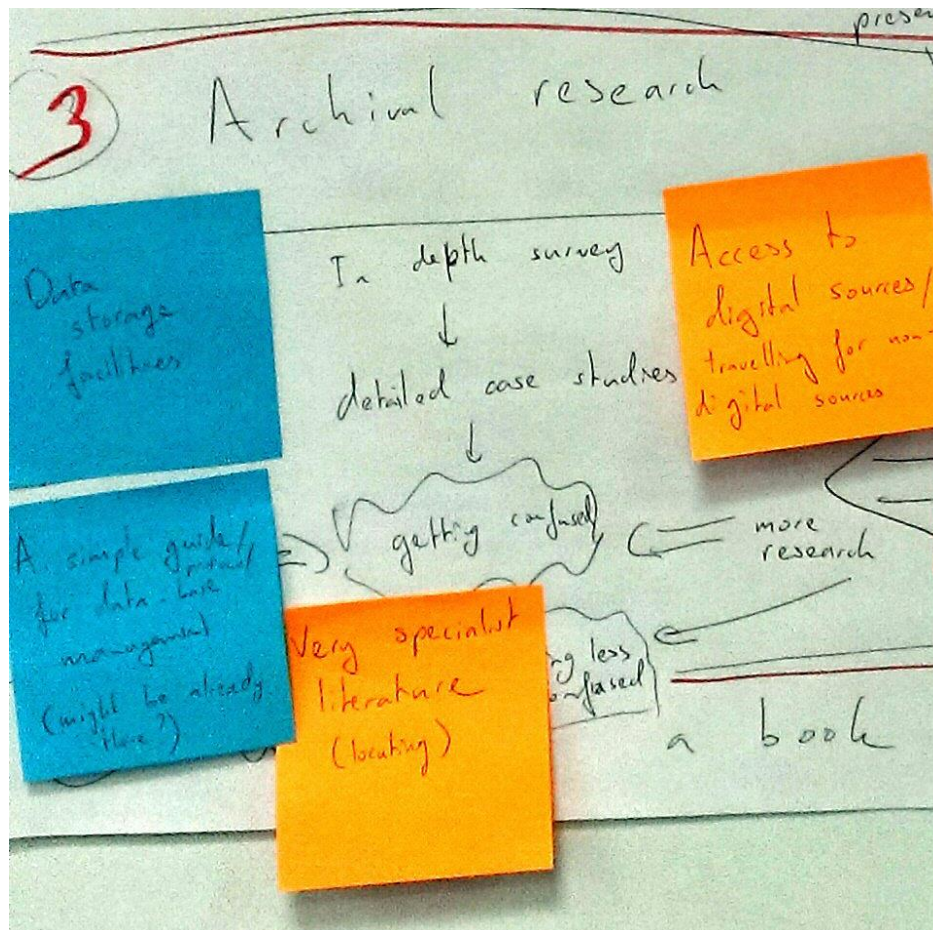


Figure IV: A collection of data-related challenges (orange) and proposed RDS (blue) by Participant H, a postdoctoral researcher in history

There were other access issues that participants felt the library could help to address through RDS. Participant A, who proposed the web research portal, said that she would benefit from the library's assistance in linking to disciplinary data repositories. In her work, she draws upon existing datasets and, as such, likely recognized the value of connecting researchers to places where shared data can be accessed.

For Participant E, a researcher who studies information behavior and users' understandings of technologies, locating research participants to interview or to contact with a survey is often a challenge that stands between her and her data. In a design proposal that was met with enthusiasm from her fellow focus group participants, she advocated for the library's creation and maintenance of a research participant registry. Individuals, she suggested, could volunteer to be included in the registry, and provide their name, status, discipline (if applicable), university status (if applicable), age group, and contact information. She said that the anticipated benefits include being able to search this registry and have returned individuals

who then she could recruit for an interview, focus group, or survey. Another researcher suggested that volunteers could also note if they are interested in participating in studies that provide a minimum compensation.

Understanding impact of research

In the second focus group session, two participants expressed an interest in library assistance in better understanding the impact of their research following publication. One researcher, who also expressed a desire to be able to search the library catalog for impact factor, said a “reference notifier” tool would be useful to him (Figure V). He explained,

“If I could get an email whenever some of my stuff has been referenced, that would be good.... It would be good to know my reach then. Or if a subset of people are suddenly talking about something I wrote before, I might want to revisit that or revamp that or engage in the conversation with those people.”
- Participant F

Such interest supports the development of bibliometrics services as part of the library RDS suite.



Figure V: A post-publication RDS by Participant F: a “reference notifier” that alerts him when his publications are cited

Not knowing what infrastructure and services are in place

Participants looked to the library as a potential resource for communicating the research data infrastructure and services in place at the [removed institution]. For example, one researcher said that it is unclear to him what data storage options exist for him. He remarked,

"It is not often easy for researchers to know what is there and about the facilities and where to put your stuff. So basically it ends up being in your closet or on these disks and they go out of fashion at some point but that is never something that you think about at the time. You just think, I'll have it in 20 years time but of course you will not be able to use it in 20 years time (Participant H).

The library, he suggested, could help to demystify how he can best store his data for the long-term and reveal what infrastructure is in place at the [removed institution] to aid him in doing so.

At times, participants expressed interest in library or institutional services already in existence but that they did not know were in place. For example, a researcher who is a relatively recent arrival to the [removed institution] described his past challenges to accessing library resources when in the field. We informed him how he can login remotely through the library's website, which he did not know how to do. After developing a research question, another researcher said that would be useful for her to be able to meet with a librarian about conducting a literature review. This is a service that liaison librarians currently provide to users. This study suggested that it may be an opportunity to also engage users in the design of the communications plan for services.

VI. Conclusion

Using visual narrative inquiry was, in the opinion of the research team, an effective way to enter into a conversation about participants' research data practices and to encourage them to reflect on their data-related challenges. We were unable, however, to draw disciplinary conclusions from the participants' sketches and design proposals. They were very much participating as individual researchers and not objective representatives of their disciplines. This was manifested in their sketches of the research process. Participants presented a research process that was more personal and, in most cases, more imperfect than the research lifecycle models that academic libraries are increasingly using for RDS development and communication. Academic libraries, then, cannot take for granted that researchers may be conceptualizing the research process in ways that do not align to neat and neutral lifecycle models.

There is more analysis to be performed with this study. We now have a collection of researcher-generated research lifecycle models that will continue to grow as more focus groups are conducted using this methodology. Moreover, this is only the first step in participatory design of RDS. Design itself, like the some of the research processes that the participants illustrated, is an iterative process of information gathering, observation, brainstorming, prototyping, and testing (Stanford Design Program and Stanford Arts Institute, 2012). In order to determine whether a "distilled" guide on data management best practices is distilled from the perspective

of the historian who proposed its creation, we would have to bring this participant (or, at the very least, a participant from his discipline and at his career stage), back into the fore throughout the design process.

This study has a number of implications for the [removed institution]. First, the study flagged users' gaps in understandings of existing library and university services. We were able to address these gaps in understandings during and following the focus group sessions. As examples, we explained to one participant how to login to the library resources when he is off-campus. For another participant who wanted the sync files he stores in a cloud , we followed up to inform him about how to do this using the cloud storage solution that the [removed institution] provides. We will be sharing back to the liaison librarians who support the academic departments that represented in this study to share where there are these gaps in knowledge. Moreover, findings related to data-related challenges and proposed solutions will be presented to colleagues who are involved in the development of RDS.

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